

CLAIMS

1. A screw-type magnetorheological damper, comprising:

a thrust shaft comprising an external threaded surface in threaded communication with a sealed housing, wherein at least one end of the thrust shaft extends from the housing;

at least one rotor disposed in the housing comprising a planar surface with a centrally located aperture that is rotatably engaged with the threaded surface of the thrust shaft;

at least one stator spaced apart from and adjacent to the at least one rotor, wherein the stator is fixedly attached to the housing and comprises a centrally located aperture dimensioned to accommodate vertical movement of the thrust shaft and a planar surface substantially parallel to the planar surface of the at least one rotor;

a magnetorheological fluid disposed in a space defined by the at least one rotor and the at least one stator; and

means for applying a substantially perpendicular magnetic field to the magnetorheological fluid relative to the planar surface of the at least one stator.

2. The screw type magnetorheological damper of Claim 1, further comprising at least one alignment bearing positionally disposed about the at least one rotor to carry thrust loads and maintain clearances between the adjacent stator and the at least one rotor.

3. The screw type magnetorheological damper of Claim 1, wherein the means for applying a substantially perpendicular magnetic field comprises a coil of wire about the at least one stator and a power source in electrical communication within the coil.

4. The screw type magnetorheological damper of Claim 1, wherein the means for applying a substantially perpendicular magnetic field comprises a permanent magnet formed in the stator.

5. The screw type magnetorheological damper of Claim 1, wherein the at least one rotor and the at least one stator are alternatingly arranged in the housing.

6. The screw type magnetorheological damper of Claim 1, wherein the magnetorheological fluid comprises carbonyl iron and an inorganic material selected from the group consisting of zinc oxide, silicon dioxide, molybdenum sulfide, and boron nitride.

7. The screw type magnetorheological damper of Claim 1, wherein the magnetorheological fluid comprises ferromagnetic or paramagnetic particles or particulates dispersed in a carrier fluid.

8. The screw type magnetorheological damper of Claim 1, wherein the means for applying a magnetic field comprises a permanent magnet or an electromagnet.

9. The screw type magnetorheological damper of Claim 4, wherein the particles are in an amount of about 5 to about 75 percent by volume of the magnetorheological fluid.

10. The screw type magnetorheological damper of Claim 1, wherein the at least one stator spaced apart from and adjacent to the at least one rotor is at a distance of about 0.1 to about 2 millimeters.

11. The screw type magnetorheological damper of Claim 1, wherein the at least one stator spaced apart from and adjacent to the at least one rotor is at a distance less than about 2 millimeters.

12. A screw-type magnetorheological damper, comprising:

a thrust shaft comprising an external threaded surface in threaded communication with a sealed housing, wherein at least one end of the thrust shaft extends from the housing;

a plurality of rotors and stators alternatingly arranged in the housing, wherein the plurality of rotors comprise a planar surface with a centrally located aperture that

is rotatably engaged with the threaded surface of the thrust shaft, wherein the plurality of stators is fixedly attached to the housing and comprises a centrally located aperture dimensioned to accommodate vertical movement of the thrust shaft and a planar surface substantially parallel to the planar surface of the at least one rotor, and wherein alternating stators comprises a permanent magnet or an electromagnet; and

a magnetorheological fluid disposed in a space defined by the plurality of rotors and stators.

13. The screw-type magnetorheological damper of Claim 12, wherein the pluralities of rotors and stators comprises (n) stators and (n+1) rotors, wherein n is an integer.

14. The screw-type magnetorheological damper of Claim 12, further comprising at least one alignment bearing positionally disposed about the at least one rotor to carry thrust loads and maintain clearances between the adjacent stator and the at least one rotor.

15. The screw type magnetorheological damper of Claim 12, wherein the magnetorheological fluid comprises carbonyl iron and an inorganic material selected from the group consisting of zinc oxide, silicon dioxide, molybdenum sulfide, and boron nitride.

16. The screw type magnetorheological damper of Claim 12, wherein the magnetorheological fluid comprises ferromagnetic or paramagnetic particles or particulates dispersed in a carrier fluid.

17. The screw type magnetorheological damper of Claim 12, wherein the means for applying a magnetic field comprises a permanent magnet or an electromagnet.

18. The screw type magnetorheological damper of Claim 12, wherein the particles are in an amount of about 5 to about 75 percent by volume of the magnetorheological fluid.

19. The screw type magnetorheological damper of Claim 12, wherein the plurality of rotors and stators alternatingly arranged in the housing are spaced apart at a distance of about 0.1 to about 2 millimeters.

20. The screw type magnetorheological damper of Claim 12, wherein the plurality of rotors and stators alternatingly arranged in the housing are spaced apart at a distance less than about 2 millimeters.

21. A process for operating a screw-type magnetorheological damper for variably converting a linear force to a rotary force, comprising:

axially applying a force to a thrust shaft of a screw-type magnetorheological damper, wherein the screw-type magnetorheological damper comprises the thrust shaft having an external threaded surface in threaded communication with a sealed housing, at least one rotor disposed in the sealed housing comprising a planar surface with a centrally located aperture that is rotatably engaged with the threaded surface of the thrust shaft, at least one stator spaced apart from and adjacent to the at least one rotor, wherein the stator is fixedly attached to the housing and comprises a centrally located aperture dimensioned to accommodate vertical movement of the thrust shaft and a planar surface substantially parallel to the planar surface of the at least one rotor, and a magnetorheological fluid disposed in a space defined by the at least one rotor and the at least one stator; and

variably applying a substantially perpendicular magnetic field to the magnetorheological fluid relative to the planar surface of the at least one stator so as to variably convert the linear force applied to the thrust shaft into the rotary force.

22. A magnetorheological damper, the damper comprising:

a cylindrically shaped housing;

a magnetorheological fluid disposed in the cylindrically shaped housing;

a piston assembly disposed within the cylindrically shaped housing in sliding engagement with the cylindrically shaped housing defining a first chamber and a

second chamber, wherein the piston assembly comprises an annular starburst flow channel extending from the first chamber to the second chamber, and an electromagnet centrally disposed in the piston assembly; and

a power supply in electrical communication with the electromagnet.

23. A magnetorheological damper, the damper comprising:

a cylindrically shaped housing;

a magnetorheological fluid disposed in the cylindrically shaped housing;

a piston assembly disposed within the cylindrically shaped housing in sliding engagement with the cylindrically shaped housing defining a first chamber and a second chamber, wherein the piston assembly comprises a plurality of spiral shaped openings extending from the first chamber to the second chamber, and an electromagnet centrally disposed in the piston assembly; and

a power supply in electrical communication with the electromagnet.